CLASSIFICATION RESTRICTED
SECURITY INFORMATION
CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT [redacted]
CD NO.

STAT

COUNTRY	China	DATE OF INFORMATION	1950
SUBJECT	Transportation - Rail, bridge		
HOW PUBLISHED	Monthly periodical	DATE DIST.	23 May 1952
WHERE PUBLISHED	Peiping	NO. OF PAGES	5
DATE PUBLISHED	Jan 1951		
LANGUAGE	Chinese	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Jen-min T'ieh-tao (People's Railways), Vol III, No 1, 1951.

STRENGTHENING THE YELLOW RIVER BRIDGE OF THE PEIPING - HANKOW RR

Li Chia-ch'i

Description of Original Bridge

The Ching-Han railway bridge over the Yellow River was constructed 50 years ago as a semipermanent structure. Originally the bridge was 3,010 meters long and had 102 spans. During the Sino-Japanese war it was destroyed and later repaired by the Japanese who filled in solid one span at each end of the bridge. It now has 100 spans and is 2,942.8 meters long. Structures used in this bridge are of three types:

1. Japanese military bridge material used for 86 spans, of which 34 spans are 32 meters long, with five longitudinal beams (or truss girders) each, double-frame deck type; and 52 spans are 21.5 meters long, with three longitudinal beams (or truss girders) each, double-frame deck type.

2. Pratt-type semithrough single frame trusses used for 11 spans, each 31.5 meters long. These are the only original material of the old bridge still in use.

3. Three spans of the Warren-type semithrough trusses, each 31.5 meters long. These were brought here from some other place.

The piers for the entire bridge are of special construction. Each pier is constructed of from four to six threaded steel piles screwed into the bed of the river, with a frame on top to support the trusses. As the result of battle damage, the whole bridge was defective to such an extent that prior to liberation it was generally considered that it could no longer be used. American engineers were called in to design an entirely new bridge, and the old one was allowed to sink into a condition of extreme neglect. When the bridge was used by the Japanese and by the Nationalists in the postwar period, the trains had

CLASSIFICATION RESTRICTED

STATE	X	NAVY	X	NSRB		DISTRIBUTION						
ARMY	X	AIR	X	FBI								

STAT

to be divided into two sections and drawn across the bridge by small locomotives at a speed of not more than 5 kilometers per hour. Although the distance between the two stations on either side of the bridge was only 5 kilometers, it required 3 hours for an entire train to make the crossing. This was the condition of the bridge up to the time of liberation in 1949.

Opinion of Soviet Experts on Strengthening Bridge

In November 1949, the bridge was inspected by a commission of Soviet engineers headed by Chikorenko [approximation from the Chinese]. They stated that provided the bridge was repaired, strengthened, and carefully maintained, it would be possible not only to extend the period of usage but also to increase the safe speed of trains and to use heavy locomotives. Their recommendations consisted of two parts:

1. Recondition the existing structures and accessories, add guard rails, and use two small locomotives, separated by two empty cars, to draw a whole train at a speed of 15 kilometers per hour. These measures were taken by the Cheng-chou Railway Bureau and the bridge was put into use from 4 January 1951 with good results, i.e., the time required for a train to cross was reduced to one eighth that previously required.

2. Dismember some parts of the bridge trusses and test their strength to calculate the carrying capacity of the trusses of which they were a part, and then to strengthen the trusses with additional material until it was certain that they could safely carry heavy locomotives. The commission was of the opinion that after such strengthening, it would be possible to prolong the useful life of the bridge, and that in view of the present financial and material conditions in China, it was advisable to continue to use the old bridge as long as possible and not to try to build a new bridge.

Plans for Reinforcement

The Ministry of Railways sent their structural engineers, Ku Mao-hsun and two associates, to the bridge site to work out with the Soviet advisors reinforcement and rehabilitation plans. Their specific objective was to strengthen the trusses to the point where they could safely carry heavy locomotives of the Mogul VI type.

Specimens of members from all three types of trusses were tested as to strength, and on the basis of these tests and in the light of the Soviet advisor's experience with structural steel, the unit working stress factor was raised. The strength of the steel in the Japanese military bridge material was put at 2,000 kilograms per square centimeter. Test of the steel in the 11 old spans showed it to be not very good; but in order to use it, its maximum strength was put at 1,400 kilograms per square centimeter. On this basis the strength of all the spans was calculated with the following results:

1. Of the 32-meter long trusses, the weakest was classified as having a rating of C 6.2.

2. Of the 21.5-meter long trusses, the weakest was classified as having a rating of C 9.9.

3. Of the 11-old trusses, the weakest was classified as having a rating of C 11.

4. Of the three Warren-type trusses, the weakest was classified as having a rating of C 17.

STAT

The method of reinforcing decided upon was as follows:

Since a bridge should be rated at C 12 or C 13 to carry a heavy Mogul VI locomotive, the Warren-type trusses could be used safely without any reinforcement. The 11 spans of the second type could be made strong enough by adding to each of their upper and lower chords steel strips 10 millimeters thick and 75 millimeters wide.

Concerning the Japanese military trusses of the first type, it was noted that the upper frame (A) rested upon, but was separate from, the lower frame (B), both being of the same height. Also, it was noted that the upper chords of the upper frame, AU, had one more steel plate than the lower chords, AL; and that the lower chords, BL, of the lower frame had one more steel plate than the upper chords, BU. In other words, the chords AU and BL consisted of a channel and a plate rivetted together (see appended figures).

The 32-meter Japanese military-type trusses are made up of nine panels, each 3 meters long, plus two panels (one at each end, adjacent to the piers) each 2.5 meters long.

It was then observed that if chords AL and BU, which are in juxtaposition with each other, were bolted or rivetted together with a sufficient number and strength of bolts or rivets so that the upper and lower frames functioned as a single truss, then the chords which are bolted together would not be subjected to any bending stresses, for the bending stresses would be carried wholly by AU and BL.

Now let M_2 represent the resistance [to bending] moment of the two unconnected frames and M_1 be the resistance moment of the two frames when connected. Also, let S be the area of cross section of the chords AU and BL, that is, those with the additional steel plates, and s be the area of cross section of the chords AL and BU, those without the extra plates. Let f be the unit stress, and d be the height of a single frame. Then

$$M_2 = s \times f \times d + s \times f \times d = s \times 2fd$$

$$M_1 = S \times f \times 2d = S \times 2fd$$

S is manifestly greater than s. Hence M_1 is greater than M_2. Thus, by uniting the upper and lower frames, and without additional strengthening material their joint moment of resistance is greatly increased, and the load rating for the 32-meter spans could be raised from C 6.2 to C 13.3; and that of the spans 21.5 meters long could be raised from C 9.9 to C 14.2. Thus, Mogul VI locomotives could be used on them. As to the number and size of bolts to be used to join each pair of chords, this was calculated by using a simple formula relating to shearing force.

Work of Rehabilitation

Apart from the work of strengthening the 11 old spans and of stiffening the military trusses explained above, there were several other matters that had to be attended to. Some cross braces and lateral braces had to be added to counteract wind pressure and locomotive swaying. All the old ties were replaced with new creosoted ties. All the old rails were replaced with new rails manufactured in the USSR. All the steel work was given three coats of paint. All damaged members of the military trusses were replaced by perfect pieces. All damaged members of the 11 old spans were either repaired or replaced.

The actual repair work was begun 15 May 1950, and it was expected to finish it by the end of September 1950. The greatest difficulty encountered was the necessity of maintaining railway service while the work was going on. Service was discontinued for only 2 hours at a time, morning and afternoon. In spite of all difficulties, the work was completed 18 September 1950, 12 days ahead of schedule.

When tested with a Mogul VI locomotive, the greatest deflection of the Warren-type trusses was only 17 millimeters; and of the 11 Pratt-type trusses, 27 millimeters, which is less than 1/1000 of the length of the spans. In the case of the 32-meter military spans, which before strengthening were deflected 70 millimeters when a small locomotive was used, after strengthening, the heavy Mogul VI caused a deflection of only 55 millimeters is about 1/600 of the length of the span. The military trusses being of special construction, where each 3-meter section is bolted to its neighboring section, the permissible deflection, even under ideal conditions, is greater than for ordinary trusses, and may be as much as 1/400 of the length of the truss. Thus from the standpoint of deflection, these latter trusses are now much stronger than before.

Value of this Experience

With the help of the technical experience of the USSR advisers, this old, many times damaged, bridge has been restored to its former usefulness. Since its construction in 1906, it never carried locomotives as heavy as the Mogul VI locomotives, weighing 146 metric tons, which it is now able to carry. It has now been in use for 3 months, and the Cheng-chou Railway Bureau reports that it is giving good service. Trains may now pass between Cheng-chou and Hsin-hsiang without stopping to change to small locomotives for the crossing of the Yellow River bridge. This saves one hour's time, and dispenses with five small locomotives.

/Appended figures follow:/

Sanitized Copy Approved for Release 2011/10/06 : CIA-RDP80-00809A000700060427-0

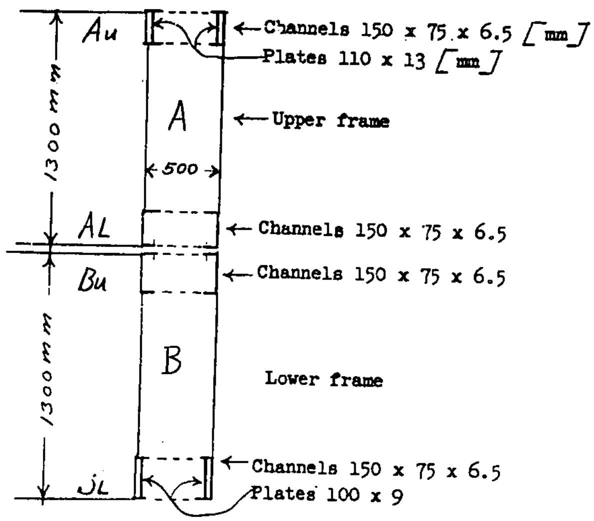

Figure 1. Cross Section of One Longitudinal Beam (Truss Girder) of Upper and Lower Frames of the Japanese Military-Type Bridge Spans (of which there are five or three such beams in each frame)

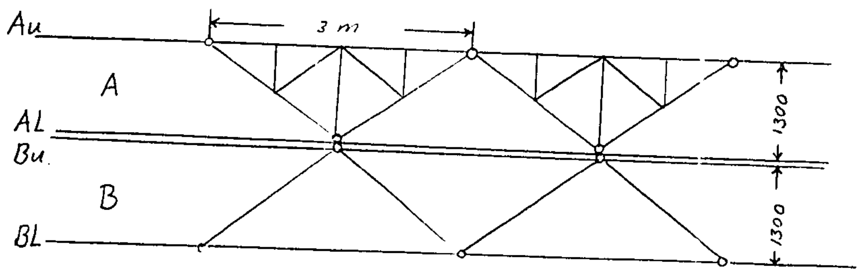

Figure 2. Design of Bracing of Longitudinal Beams (Truss Girders)

- E N D-